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the Madras Presidency, on 24 sheets, presented by the Indian Office; by Major D. Hamilton. Map of Les Monts Maudits in the Pyrenees.

The PRESIDENT said he had much gratification in announcing that the Council had this day elected his Royal Highness the Duke of Edinburgh an Honorary Fellow of the Society. His Royal Highness had been himself a traveller in distant regions, and was well qualified to appreciate the labours of the Society. The members would learn with great satisfaction that he had expressed his sincere pleasure in becoming one of them.

The following Papers were read:—

1. *On the Effect of the Destruction of Forests, in the Western Ghauts of India, on the Water Supply.* By C. R. MARKHAM, Esq., F.R.G.S.

THIS paper contained the results of observations made by the author during a recent visit to the chinchona plantations on the Neelgherries and other mountains of Southern India. These mountain districts contain the sources of a water-supply on which the prosperity—indeed, the very existence—of millions depends. The most northern part of the range is comprised in the two Mysore districts of Nuggur and Munjerabad, and it is continued through Coorg, Wynaad, and the Neilgherries to the remarkable gap at Palghat, which enables the railroad to pass from sea to sea, and beyond the gap comprises the Anamallay, Pulney, and Travancore hills. The rainfall along this range is derived almost exclusively from the South-west Monsoon between May and September, but the amount decreases as Cape Comorin is approached. Near Bombay it is 248 inches, while at the capital of Travancore it is 65, and at the Cape only 30 inches. The clouds heavily charged with moisture from the Indian Ocean part with it on first entering the colder stratum caused by the mountains, the rainfall sensibly diminishing eastward across the plateaux, and being curiously affected by the smallest variations of aspect and shelter. Within the last 20 years a great change has come over these forest-clad mountain districts, in the establishment of many English planters, who have brought great material blessings to the natives, but, in the extensive clearings of trees which they have necessarily made, have brought about a deterioration of the climate. In all, a total area of 180,000 acres of forest has been cleared for coffee, tea, and chinchona plantations. One effect of this has been the occurrence of sudden floods, which have increased yearly in volume and destructiveness. There is a system of forest conservancy in the Madras Presidency, and the present superintendent, Dr. Cleghorn, is a zealous and able man, but Mr. Markham did not advocate Government interference with the development of plantations; he looked for help rather to the formation of reservoirs in the hill districts to regulate the supply of moisture to the great plains in the East, which depend for their habitability on their rivers and irrigation works, fed by the mountain rains. The chinchona plantations, when grown up, would compensate to a great degree for the destruction of the forests, the shade of the trees preserving the moisture beneath them. The storing of water in reservoirs can be effected at about the rate of 100*l.* of capital for a million cubic yards of contents, besides what would be drawn off and again replaced during the monsoon.

The paper will be printed in the Journal, Vol. xxxvi.

The PRESIDENT, in returning the thanks of the Society to Mr. Markham, said the subject was one of very great interest to all physical geographers. It was a subject upon which he had himself much reflected in reference to other countries, even our own country; for, owing to the improvements in agriculture and increased drainage, a decrease in the volume of our rivers had become plainly perceptible. He was happy to see many gentlemen present connected with India; and he would, in the first instance, call upon Sir William Denison, late Governor of Madras, to offer some observations upon the subject. Under his able administration some of those very operations had been undertaken to which Mr. Markham had alluded. He might add that Sir William Denison had become a Member of Council of the Society.

Sir WILLIAM DENISON said he would narrate a few observations which he had made with respect to particular localities in the territory of Madras, which would illustrate the subject that Mr. Markham had brought forward. The Western Ghauts terminated by a block of hills, called the Neilgherries, rising to an altitude of about 7000 or 8000 feet. South of this there was a gap, about 40 miles wide, rising about 1000 feet above the level of the sea. Then came the Annamallay mountains, which rose to the height of 6000 feet. This gap is exposed to the full force of the Western Monsoon, and one would imagine that it ought to carry the great rainfall right into the very centre of India. In 1861, on his first visit to the west coast, he was much struck to find that for about 500 feet below the top of this 1000 feet the ground was as dry as a road; the railroad train, in descending the gradient, rushed from a brown dry desert country into a rich bamboo-jungle, as green and beautiful as possible. He asked the reason, and was told that the Western Monsoon terminated at the line of separation. You might almost stride across the division between green and brown, and have one side of you rained upon and the other not; at first he was disposed to consider the presence of the jungle as the *effect* of the rain of the monsoon, but a year or two afterwards, he happened to be conversing with the collector of the district, who said he had known the limit of the rainfall recede seven miles in consequence of the forest having been cleared away; and he then found out that the jungle was the *cause* of the rainfall. The same thing was proceeding in more or less degree throughout all India. When the native wanted fuel he cut down a tree without the least hesitation, and no one ever dreamt of planting a tree unless it were a fruit-tree. In this way the whole country was gradually laid bare. He had travelled for 600 miles in the Mysore and had never seen a tree except those that border the roads. Naturally enough no rain fell, and they were obliged to "bottle up" every drop of rain they could possibly collect. In every valley there was dam after dam in connection with the minor streams. Among the larger streams there was yet a great deal to be done by damming the waters of the heavy monsoon rains, to be let out in small quantities, as required, for the benefit of the country.

General G. BALFOUR said he rose with great pleasure to bear testimony to the great services which Mr. Markham had rendered to India. After having introduced into that country the chinchona-plant, which there was no doubt would prove of great benefit, he had visited India a second time in order to examine the result of his former labours, and had brought back some exceedingly useful ideas upon an important subject. Forty years ago, as a member of the Public Works Commission, he himself had called attention to the influence which water had on the prosperity of the country; and many years ago his brother prepared two excellent Reports for the Madras Government, in which he urged with great force the importance of preserving the trees. The great tract of country which Mr. Markham had mentioned—an area greater than that of Ireland—is almost destitute of water, in consequence of the destruction of the trees. He hoped, however, that a change was about to take place. He could himself speak to the great results which might be expected from the works of the Madras Irrigation Company. The value of water would be appreciated when it was known that irrigation more than quintupled the produce raised from the ground. With regard to the preservation of trees, he thought a great deal might be done in India. In the Punjaub rewards were given to the cultivators of trees. In former times it was the practice of rich Hindoos to sink wells and plant topes of trees, no doubt for the purpose of catching water. In the Mauritius the Government had passed laws to prevent the cutting down of trees, and the result has been to secure an abundant rainfall.

Mr. J. CRAWFURD said no one could doubt that Mr. Markham had been a great public benefactor to India; but with respect to the clearing away of the forests being adverse to the progress of a community, he must differ from that gentleman. It was quite the reverse, and so much the better. The presence of immense forests had proved one of the greatest obstacles to the early civilisation of mankind. The prairies of North America and the pampas of South America formed the very best land for the uses of man, especially in North America. Again, Upper Hindostan was totally free from forest, there being nothing but cultivated orchards; and it was a better country than the Madras country, a very flourishing region, paying a large revenue and containing a far more dense population than the Madras country. With respect to the benefits conferred by irrigation, they were unquestionable. The people of Madras would not have become what they are had it not been for irrigation; in fact, the population of India had been created by irrigation. Then, again, Java was free from forest, and it was incomparably superior to all the other islands of the Indian Archipelago; more civilised, and more densely populated. He thought the coffee-plant as useful for cultivation and retaining the moisture of the surface as the chinchona-plant. To revert to the question of irrigation, he hoped it would succeed. In some places irrigation-works had paid 100 per cent., and there was abundant employment for capital.

Sir HENRY RAWLINSON wished to say a few words in reference to the value of forests in promoting rainfall. Java, or any tract of land close to a sea exposed to the monsoons, was not a fair criterion. Where there are trade-winds bringing constant periodical rains you will get a rainfall, whether there is forest or no forest; but in the case of inland plains, beyond the influence of the trade-winds and the periodical rains, there you will find the effect most marked and most certain. He had observed it in many cases, and had verified it by comparing the present state of countries with their past state, as recorded in history. Take, for instance, the great plains of Mesopotamia. In early times we know, from Assyrian sculptures and from history, they were covered with woods, so much so that in the campaign of Julian the Apostate the Roman soldiers passed from one river to the other entirely under the shade of trees, without ever feeling a ray of the sun. At that time there were constant showers, and the country was not only fertile but the climate was agreeable. The Arabs, when they first looked upon the valley of the Tigris and Euphrates, called it the "Green Paradise," from its excessive fertility—a fertility caused by periodical rains. Now it was a burnt-up desert, and no rain at all falls for six months in the year, from the beginning of May to October, and when it falls in October, after the heats, it is not as a periodical rain, but simply a condensation of the vapour. The whole of Persia was another notorious example. That was formerly a thickly-populated and fertile country, with an agreeable climate and a constant rainfall. The clearing of forests there was a matter of history. They had disappeared to furnish charcoal to the inhabitants. Until the last few years there was no such thing as coal known in the country. The more the people had become civilised the more they had required fuel, and the forests were disappearing year after year. It was a matter patent to every traveller, and it might be adopted as a principle in physical geography, that the desiccation of a country followed upon the disappearance of its forests. He heartily agreed with Mr. Crawfurd in one respect, namely, that the thanks of the Society were due to Mr. Markham for the public service he had rendered in naturalising the chinchona-plant in India.

Mr. TORRENS stated that for twenty-five years he had resided in the colony of South Australia. At the commencement of this period the great plain of Adelaide, extending 100 miles along the sea-board, and about 10 miles in width, was crossed in many places by belts of forests. While these forests remained intact they had a regular rainfall every summer. The hot winds, which prevailed extensively in that region, were invariably succeeded by heavy thunder-storms, bringing down copious falls of rain, and these enabled the people to cultivate the melon, the pumpkin, and a great variety of plants, which they had since been compelled to abandon. The belts of wooded land were found to be exceedingly fertile, and the timber was cut down recklessly and thoughtlessly: the result had been that during the last fifteen years these heavy summer rains had entirely disappeared.

The PRESIDENT thought, from the discussion which had taken place, that Mr. Markham had well established his point. In his Annual Address he (the President) had referred to the transportation of the chinchona-plant to India, and the great public service which Mr. Markham had rendered.

SIR WILLIAM DENISON, interposing, said he could testify, from his own experience, that the cultivation of the chinchona-plant had succeeded most admirably, and was likely to be productive of very great benefit to India and the world at large.

The PRESIDENT said he had been asked by Mr. Markham to make some observations on the geological formation of Southern India, with reference to drainage. There could be no doubt that the gneiss of Central India was one of our most ancient, most crystalline, and most durable formations. That water should run off rapidly from rocks of that character was but natural, and it showed that the formation of tanks and dams in other parts of the country, which Sir William Denison had alluded to, was most desirable. He ventured to say that this fundamental rock, the backbone of India, was a primordial gneiss, showing that the continent of India was a very ancient one, and none of the other intermediate formations were found, as is the case in Europe. His opinion of the subject completely confirmed Mr. Markham, that if you deprive such a country of its trees, roots, and mosses, by which you hold water as it were in a sponge, the monsoon rainfall will necessarily run off in great and transient floods.